The New Millennium Deep Space One Mission. R.M.Nelson, E. R. Stofan, C. A. Raymond, M. D. Rayman, All at Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena CA 91109, Robert.M.Nelson@jpl.nasa.gov

NASA's New Millennium Program will launch a series of space flights intended to validate the technologies required for future deep space and Earth orbiting science missions. The program represents a challenging new way for NASA to bring to flight readiness new technologies that will meet the requirements for future science exploration.

The first flight of the series, Deep Space One, will be launched on 1 July 1998. The spacecraft will fly by asteroid 3352 McAuliffe on 26 Jan 1999, Mars on April 20, 2000 and periodic comet West-Kohoutek-Ikemura on 1 June 2000.

The goal of the Deep Space One mission is to validate the new technologies and to investigate small solar system bodies. Additional opportunities may exist to achieve some unusual scientific investigations at Mars that will not be carried out by Mars Pathfinder, Mars Global Surveyor, or Mars 98.

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Thirteen technologies have been selected for validation on Deep Space One including two scientific instruments, the Miniature Integrated Camera Spectrometer (MICAS) and the Plasma Experiment for Planetary Exploration (PEPE). The flight will also validate a solar powered electric ion propulsion system, a small deep space transponder, a Ka-band solid state power amplifier, and autonomous onboard navigation.

Science goals for the Deep Space One mission have been designed such that they are achievable within the technical capabilities of the mission. They have been derived directly from the NASA program strategy to develop missions that are focused on a limited set of scientific objectives.

The specific Deep Space One goals for Asteroid 3352 McAuliffe are, to the extent feasible:
1) Investigate the asteroid's gross physical properties including the dimensions, shape, surface morphology, albedo heterogeneity and to estimate the mass, volume, density and spin state.
2) Determine the elemental and mineralogical composition.
3) Understand the processes which govern the interaction between the asteroid and the solar wind.

The specific Deep Space One goals for comet P/West-Kohoutek-Ikemura are, to the extent feasible:
1) Investigate the gross physical properties of the comet including the dimensions, shape, surface morphology, albedo heterogeneity and to estimate the mass, volume, density and spin state.
2) Understand the coma features, plasma properties, and solar wind interactions and, in addition, determine brightness profiles of the coma, jet-like features of dust and gas, and brightness changes along and perpendicular to dust jet plasma boundaries.
3) Study the relationship between the surface features and dust jets in the coma.
4) Determine the composition of the tail.

The MICAS optical remote sensing camera has two visible imaging channels, an ultraviolet imaging spectrometer, and an infrared imaging spectrometer. The wavelength range that is spanned by the instrument is 0.08-0.185, 0.5-1.0 and 1.3-2.6 microns. In addition to science observations, MICAS will also provide spatial referencing support to the autonomous onboard navigation capability.

PEPE *in situ* plasma analyzer will measure electron and ion energies with ranges from 3 eV to 30 ke V and ion masses from 1-135 amu. It will study the effect of the effluents from the ion propulsion system on the spacecraft itself as well as the space environment, thus testing the applicability of ion propulsion to future space physics missions. The PEPE measurements will be complimented by diagnostic sensors designed to quantify the effects of the ion plasma on the spacecraft.

In addition to technology validation, each New Millennium flight is expected to return meaningful science. NASA is in the process of selecting a small science team to ensure that high quality data products will be available to the community for analysis. An Announcement of Opportunity for participation by selected members of the science community in the Deep Space One mission was recently released.